6.9.4

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, Washington 98101

IN REPLY
REFER TO: OEA-095 May 12, 1999

MEMORANDUM

SUBJECT: Bunker Hill, CLP Metals Analysis, Data Validation
Case: 26891
SDG: MJAH52

147875
USEPA SF
1125008

FROM: Laura Castrilli, Chemist
Quality Assurance and Data Unit, OEA

TO: Mary Kay Voytilla, Regional Project Manager
Office of Environmental Cleanup

CC: Bruce Woods, Region 10 CLP TPO
Jim Stefanoff, CH2M Hill

The following is a validation of ICP-AES and mercury analyses of two total and ten dissolved water samples from the Bunker Hill project. The analyses were performed following the USEPA Contract Laboratory Program Statement of Work for Inorganics Analysis Multi-media, Multi-Concentration, ILM04.0. Analyses were conducted by Sentinel, Inc, of Huntsville, Alabama. This validation was conducted for the following samples:

MJAH52	MJAH54	MJAH56	MJAH58	MJAH60	MJAH62
MJAH53	MJAH55	MJAH57	MJAH59	MJAH61	MJAH63

Data Qualifications

The following comments refer to the Sentinel Laboratory's performance in meeting quality control specifications outlined in the *CLP Statement of Work (CLP-SOW) for Inorganic Analysis, rev. ILM04.0.* The comments presented herein are based on the information provided for the review.

1.0 Timeliness - Acceptable

The technical (40 CFR part 136) holding time from the date of collection for mercury in water is 28 days. The holding time for the remaining metals in water is 180 days. The samples were collected on 04/02/99. Mercury analyses were completed on 04/07/99. ICP-AES analyses were completed on 04/18/99.

2.0 Sample Preparation - Acceptable

The samples were prepared for mercury and ICP-AES analyses on 04/06/99.

3.0 Calibrations/Calibration Verifications - Acceptable

The samples were analyzed for mercury by CVAAS on 04/07/99. Initial calibration included one blank and six standards. The curve was linear with a correlation coefficient greater than 0.995.

The samples were analyzed by ICP-AES on 04/08/99 (main analyses), 04/09/99 (iron, manganese and/or zinc ten fold dilutions), 04/12/99 (hundred fold dilutions), and 04/18/99 (thousand fold dilution for zinc). The instrument was standardized according to the analytical method each day of analysis using one blank and a single calibration standard for each element.

All ICP-AES and CVAAS (mercury) calibrations were performed as required and met the acceptance criteria; therefore, no qualification was made on this basis.

Continuing calibration verifications (CCVs) are required before and after sample analysis and after every 10 samples during analysis. Mercury recoveries must be within 80-120%. Other metal recoveries must be within 90-110%. The frequency of analysis of CCVs was met. All ICP-AES and CVAAS (mercury) CCVs (initial and continuing) bracketing reported sample results met the recovery criteria; therefore, no qualification was made on this basis.

4.0 Laboratory Control Samples - Acceptable

Laboratory Control samples are digested and analyzed along with the samples to verify the efficiency of laboratory procedures. All recoveries associated with reported sample results met the acceptance criteria.

5.0 Blanks -

Procedural blanks were prepared with the samples to show potential contamination from the digestion or analytical procedure. If an analyte was found in the associated blank, the sample results were qualified if the analyte concentration was less than five times the analytical value in the blank.

Aluminum, calcium, iron, magnesium, and potassium were detected in the preparation blank. Antimony, arsenic, iron, potassium, manganese, and zinc were detected in one or more ICP-AES continuing calibration blanks (CCBs). Lead had negative values with absolute values greater than the detection limit in the preparation blank and in a CCB. Based on blank contamination, associated sample results were qualified as follows:

- aluminum in samples MJAH58 and MJAH60 was qualified 'U'
- antimony in sample MJAH52 was qualified 'U'
- arsenic in sample MJAH57 was qualified 'U'

All other sample results were greater than five times the associated blank levels (or were already undetected) and were not qualified based on blank contamination.

6.0 ICP-AES Interference Check Sample -

The interference check sample (ICS) is analyzed by ICP-AES to verify interelement and background correction factors. Analysis is required at the beginning and end of each sample analysis run and recoveries must be between 80% and 120%. All ICS recoveries associated with reported sample results were within the recovery criterion.

The raw data for a number of samples had interfering levels of iron. Analytes for which iron is an interferent were qualified as follows:

- Vanadium in samples MJAH52 through MJAH56, MJAH58, MJAH59, and MJAH61 through MJAH63 was qualified 'UJ', estimated detection limit (possible false negatives due to high iron). Vanadium in the three ICS-A analyses bracketing these samples had negative results with absolute values greater than the detection limit.

Some of the samples required one or more dilution runs to report zinc, iron, and manganese results within the instrumental linear range. The raw data for all analytes were compared using the available dilutions to see if 1) zinc, iron, and/or manganese levels in the undiluted samples were high enough that interelement corrections may not be sufficient for the analytes that were reported from the undiluted analyses or 2) a pattern of suppression or enhancement was evident.

From this comparative study, the following results were qualified due to suspected interference (analytes already qualified due to interference or due to poor serial dilution results were not qualified again, see section 11 for qualification due to serial dilution):

- Aluminum, arsenic, beryllium, copper, manganese, and thallium were qualified 'J', estimated (pattern of suppression/possible low bias) in sample MJAH55.
- Copper was qualified 'J', estimated (pattern of suppression/possible low bias) in samples MJAH52, MJAH53, MJAH61, and MJAH62.

7.0 Duplicate Analysis - Acceptable

Duplicate analyses were done on sample MJAH52. Water duplicate results were within the ±20% Relative Percent Difference (RPD) or ±CRDL criteria for water results < 5 times the CRDL criteria.

8.0 Field Duplicate Analysis - Not Applicable

Field duplicate analysis for samples in this SDG was not indicated in the field collection documentation.

9.0 Matrix Spike Analysis -

Matrix spike sample analyses are done to provide information about the effect of the sample matrix on digestion and measurement methods. Matrix spike recovery must be within the limits of 75 - 125%.

Matrix spike analyses were done on sample MJAH52. All matrix spike recoveries were within the required QC limits, with the exception of antimony (67.6% recovery) and selenium (zero percent recovery). All antimony results were qualified 'J', estimated (possible low bias). Due to the zero recovery for selenium, all undetected selenium results (most samples) were qualified 'R', unusable. Selenium was detected in sample MJAH58 and was qualified 'J', estimated (possible low bias).

10.0 Graphite Furnace Atomic Absorption Spec (GFAAS) QC - Not Applicable -

GFAAS was not used for the analysis of these samples.

11.0 ICP-AES Serial Dilution -

Sample MJAF49 was analyzed by ICP-AES serial dilution to check for potential interferences. All analytes which exceeded the minimum concentration criterion (50 times the IDL) agreed within the 10%D criteria; with the exception of cadmium (15%), calcium (15%), cobalt (13%), lead (14%), magnesium (14%), nickel (14%), potassium (27%), silver (39%), and sodium (100%). The serial dilution for nine out of twenty-two of the ICP analytes is outside the acceptance criteria.

It is suspected that there may be an large interference problem with the sample analyzed for serial dilution. All of the raw data for the samples that required dilution for reporting iron, manganese, and/or zinc were closely examined to see if there was agreement between the native and ten fold dilution analyses. Based on the reviewer's professional judgement, if the ten fold dilution agreed within 10%D with the native analysis (in some cases the ten fold dilution was compared to the hundred fold dilution as the native result was greater than the linear range), the analyte with the 'poor' serial dilution (five fold dilution) result was not qualified. Analytes with poor serial dilution results and no or poor ten fold dilution results were qualified 'J', estimated.

The following analytes were not qualified based on serial dilution results (laboratory 'E' qualifiers were removed by the reviewer):

- Cobalt in sample MJAH52 (even though this was the serial (five-fold) dilution sample, cobalt in the native, ten-fold and one hundred-fold dilutions agreed within 10%D).
- Cadmium, cobalt, lead, magnesium, and potassium in sample MJAH53.

- Cadmium, cobalt, lead, nickel, magnesium, potassium, and silver in sample MJAH54.
- Calcium, cobalt, lead, nickel, magnesium, and silver in sample MJAH58.
- Cadmium, cobalt, lead, nickel, magnesium, and potassium in sample MJAH59.
- Cadmium, lead, magnesium, potassium, and silver in sample MJAH61.
- Calcium, cadmium, cobalt, lead, magnesium, and silver in sample MJAH63.

12.0 Detection Limits - Acceptable

Sample results which fall below the instrument detection limit (IDL) are assigned the value of the instrument detection limit and the 'U' qualifier is attached. Contract Required Detection Limit (CRDL) standards are required to demonstrate a linear calibration curve near the CRDL. CRDL standards were run at the required frequency.

13.0 Overall Assessment of the Data

This validation of the data is based on the criteria outlined in the *National Functional Guidelines for Inorganic Data Review (02/94).* Approximately 43% of the data was qualified based on blank contamination, interference, matrix spike recovery, or poor serial dilution results. The data as qualified is acceptable for all purposes.

Below are the definitions for the National Functional Guidelines for Inorganic Data Review (02/94) qualifiers used when validating/qualifying data from Inorganic analysis.

DATA QUALIFIERS

U - The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

J - The associated value is an estimated quantity.

R - The data are unusable. (Note: Analyte may or may not be present.)

UJ - The material was analyzed for, but was not detected. The associated value is an estimate and may be inaccurate or imprecise.

INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

MJAH52

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 26891 SAS No.: SDG No.: MJAH52

Matrix (soil/water): WATER Lab Sample ID: 18777S

Level (low/med): LOW Date Received: 04/03/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	36400			P
7440-36-0	Antimony	16.7	~~B~~	~~N~~ UJ	P
7440-38-2	Arsenic	1830			P
7440-39-3	Barium	6.5	B		P
7440-41-7	Beryllium	7.1			P
7440-43-9	Cadmium	2140		~~E~~ J	P
7440-70-2	Calcium	102000		~~E~~ J	P
7440-47-3	Chromium	0.70	U		P
7440-48-4	Cobalt	787		~~E~~	P
7440-50-8	Copper	2680		J	P
7439-89-6	Iron	963000			P
7439-92-1	Lead	524		~~E~~ J	P
7439-95-4	Magnesium	127000		~~E~~ J	P
7439-96-5	Manganese	138000			P
7439-97-6	Mercury	0.94			CV
7440-02-0	Nickel	656		~~E~~ J	P
7440-09-7	Potassium	851	B	~~E~~ J	P
7782-49-2	Selenium	~~3.1~~	~~U~~	~~N~~ R	P
7440-22-4	Silver	53.0		~~E~~ J	P
7440-23-5	Sodium	13500		~~E~~ J	P
7440-28-0	Thallium	66.9			P
7440-62-2	Vanadium	1.4	U	J	P
7440-66-6	Zinc	920000			P
	Cyanide				NR

05/12/99

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Comments:

INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

MJAH53

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 26891 SAS No.: SDG No.: MJAH52

Matrix (soil/water): WATER Lab Sample ID: 18778S

Level (low/med): LOW Date Received: 04/03/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	6650			P
7440-36-0	Antimony	3.5	U	~~N~~ J	P
7440-38-2	Arsenic	164			P
7440-39-3	Barium	36.2	B		P
7440-41-7	Beryllium	2.0	B		P
7440-43-9	Cadmium	426		~~E~~	P
7440-70-2	Calcium	36200		~~E~~ J	P
7440-47-3	Chromium	0.96	B		P
7440-48-4	Cobalt	105		~~E~~	P
7440-50-8	Copper	339		J	P
7439-89-6	Iron	198000			P
7439-92-1	Lead	694		~~E~~	P
7439-95-4	Magnesium	84100		~~E~~	P
7439-96-5	Manganese	54900			P
7439-97-6	Mercury	0.53			CV
7440-02-0	Nickel	100		~~E~~ J	P
7440-09-7	Potassium	1290	B	~~E~~	P
7782-49-2	Selenium	~~3.1~~	~~U~~	~~N~~ R	P
7440-22-4	Silver	17.5		~~E~~ J	P
7440-23-5	Sodium	106	U	~~E~~ J	P
7440-28-0	Thallium	19.6			P
7440-62-2	Vanadium	1.4	U	J	P
7440-66-6	Zinc	183000			P
_____	Cyanide				NR

05/12/99

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INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

MJAH54

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 26891 SAS No.: SDG No.: MJAH52

Matrix (soil/water): WATER Lab Sample ID: 18759S

Level (low/med): LOW Date Received: 04/03/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	12300			P
7440-36-0	Antimony	4.0	B	~~N~~ J	P
7440-38-2	Arsenic	321			P
7440-39-3	Barium	15.7	B		P
7440-41-7	Beryllium	3.9	B		P
7440-43-9	Cadmium	782		~~E~~	P
7440-70-2	Calcium	44800		~~E~~ J	P
7440-47-3	Chromium	0.70	U		P
7440-48-4	Cobalt	178		~~E~~	P
7440-50-8	Copper	587			P
7439-89-6	Iron	378000			P
7439-92-1	Lead	496		~~E~~	P
7439-95-4	Magnesium	100000		~~E~~	P
7439-96-5	Manganese	84300			P
7439-97-6	Mercury	1.6			CV
7440-02-0	Nickel	166		~~E~~	P
7440-09-7	Potassium	1190	B	~~E~~	P
7782-49-2	Selenium	~~3.1~~	~~U~~	~~N~~ R	P
7440-22-4	Silver	30.9		~~E~~	P
7440-23-5	Sodium	106	U	~~E~~ J	P
7440-28-0	Thallium	38.4			P
7440-62-2	Vanadium	1.4	U	J	P
7440-66-6	Zinc	347000			P
_____	Cyanide				NR

5/12/99

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Comments:

INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

MJAH55

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 26891 SAS No.: SDG No.: MJAH52

Matrix (soil/water): WATER Lab Sample ID: 18760S

Level (low/med): LOW Date Received: 04/03/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	170000		J	P
7440-36-0	Antimony	113		~~N~~ J	P
7440-38-2	Arsenic	7720		J	P
7440-39-3	Barium	22.6	B		P
7440-41-7	Beryllium	33.0		J	P
7440-43-9	Cadmium	7250		~~E~~ J	P
7440-70-2	Calcium	136000		E J	P
7440-47-3	Chromium	0.70	U		P
7440-48-4	Cobalt	2140		~~E~~ J	P
7440-50-8	Copper	8560		J	P
7439-89-6	Iron	12800000			P
7439-92-1	Lead	179		~~E~~ J	P
7439-95-4	Magnesium	374000		~~E~~ J	P
7439-96-5	Manganese	30800		J	P
7439-97-6	Mercury	0.87			CV
7440-02-0	Nickel	1850		~~E~~ J	P
7440-09-7	Potassium	189	B	~~E~~ J	P
7782-49-2	Selenium	~~3.1~~	~~U~~	~~N~~ R	P
7440-22-4	Silver	0.70	U	~~E~~ J	P
7440-23-5	Sodium	166000		~~E~~ J	P
7440-28-0	Thallium	249		J	P
7440-62-2	Vanadium	1.4	U	J	P
7440-66-6	Zinc	14500000			P
_____	Cyanide				NR

05/12/99

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Comments:

INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

MJAH56

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 26891 SAS No.: SDG No.: MJAH52

Matrix (soil/water): WATER Lab Sample ID: 18761S

Level (low/med): LOW Date Received: 04/03/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	63800			P
7440-36-0	Antimony	41.1	B	~~N~~ J	P
7440-38-2	Arsenic	1950			P
7440-39-3	Barium	13.1	B		P
7440-41-7	Beryllium	15.2			P
7440-43-9	Cadmium	3370		~~E~~ J	P
7440-70-2	Calcium	74600		~~E~~ J	P
7440-47-3	Chromium	0.70	U		P
7440-48-4	Cobalt	787		~~E~~ J	P
7440-50-8	Copper	4240			P
7439-89-6	Iron	2760000			P
7439-92-1	Lead	910		~~E~~ J	P
7439-95-4	Magnesium	198000		~~E~~ J	P
7439-96-5	Manganese	334000			P
7439-97-6	Mercury	1.3			CV
7440-02-0	Nickel	643		~~E~~ J	P
7440-09-7	Potassium	721	B	~~E~~ J	P
7782-49-2	Selenium	~~3.1~~	U	~~N~~ R	P
7440-22-4	Silver	104		~~E~~ J	P
7440-23-5	Sodium	47100		~~E~~ J	P
7440-28-0	Thallium	153			P
7440-62-2	Vanadium	1.4	U	J	P
7440-66-6	Zinc	2100000			P
_____	Cyanide				NR

05/12/99

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Comments:

INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

MJAH57

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 26891 SAS No.: SDG No.: MJAH52

Matrix (soil/water): WATER Lab Sample ID: 18762S

Level (low/med): LOW Date Received: 04/03/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	783			P
7440-36-0	Antimony	3.5	U	~~N~~ J	P
7440-38-2	Arsenic	16.8		U	P
7440-39-3	Barium	7.7	B		P
7440-41-7	Beryllium	0.30	U		P
7440-43-9	Cadmium	1.4	B	~~E~~ J	P
7440-70-2	Calcium	3730	B	~~E~~ J	P
7440-47-3	Chromium	4.0	B		P
7440-48-4	Cobalt	9.3	B	~~E~~ J	P
7440-50-8	Copper	168			P
7439-89-6	Iron	14700			P
7439-92-1	Lead	36.7		~~E~~ J	P
7439-95-4	Magnesium	1610	B	~~E~~ J	P
7439-96-5	Manganese	1830			P
7439-97-6	Mercury	1.5			CV
7440-02-0	Nickel	6.9	B	~~E~~ J	P
7440-09-7	Potassium	802	B	~~E~~ J	P
7782-49-2	Selenium	~~3.1~~	~~U~~	~~N~~ R	P
7440-22-4	Silver	0.87	B	~~E~~ J	P
7440-23-5	Sodium	894	B	~~E~~ J	P
7440-28-0	Thallium	4.9	U		P
7440-62-2	Vanadium	1.4	U		P
7440-66-6	Zinc	1140			P
_____	Cyanide				NR

05/12/99

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EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAH58

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 26891 SAS No.: SDG No.: MJAH52

Matrix (soil/water): WATER Lab Sample ID: 18763S

Level (low/med): LOW Date Received: 04/03/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	59.8	B	~~B~~ J	P
7440-36-0	Antimony	3.5	U	~~N~~ J	P
7440-38-2	Arsenic	3.7	U		P
7440-39-3	Barium	30.6	B		P
7440-41-7	Beryllium	0.30	U		P
7440-43-9	Cadmium	12.2		~~E~~ J	P
7440-70-2	Calcium	323000		~~E~~	P
7440-47-3	Chromium	0.70	U		P
7440-48-4	Cobalt	213		~~E~~	P
7440-50-8	Copper	10.1	B		P
7439-89-6	Iron	93200			P
7439-92-1	Lead	133		~~E~~	P
7439-95-4	Magnesium	373000		~~E~~	P
7439-96-5	Manganese	249000			P
7439-97-6	Mercury	0.86			CV
7440-02-0	Nickel	198		~~E~~	P
7440-09-7	Potassium	14700		~~E~~ J	P
7782-49-2	Selenium	60.6		~~N~~ J	P
7440-22-4	Silver	36.8		~~E~~	P
7440-23-5	Sodium	2870	B	~~E~~ J	P
7440-28-0	Thallium	174			P
7440-62-2	Vanadium	1.4	U	J	P
7440-66-6	Zinc	30500			P
_____	Cyanide				NR

dlc 05/12/99

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INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

MJAH59

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 26891 SAS No.: SDG No.: MJAH52

Matrix (soil/water): WATER Lab Sample ID: 18764S

Level (low/med): LOW Date Received: 04/03/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	6440			P
7440-36-0	Antimony	3.5	U	~~N~~ J	P
7440-38-2	Arsenic	139			P
7440-39-3	Barium	36.5	B		P
7440-41-7	Beryllium	2.0	B		P
7440-43-9	Cadmium	408		~~E~~	P
7440-70-2	Calcium	34500		~~E~~ J	P
7440-47-3	Chromium	0.70	U		P
7440-48-4	Cobalt	101		~~E~~	P
7440-50-8	Copper	309			P
7439-89-6	Iron	182000			P
7439-92-1	Lead	607		~~E~~	P
7439-95-4	Magnesium	80700		~~E~~	P
7439-96-5	Manganese	54400			P
7439-97-6	Mercury	1.5			CV
7440-02-0	Nickel	98.5		~~E~~	P
7440-09-7	Potassium	1300	B	~~E~~	P
7782-49-2	Selenium	~~3.1~~	~~U~~	~~N~~ R	P
7440-22-4	Silver	15.7		~~E~~ J	P
7440-23-5	Sodium	106	U	~~E~~ J	P
7440-28-0	Thallium	22.0			P
7440-62-2	Vanadium	1.4	U	J	P
7440-66-6	Zinc	182000			P
_____	Cyanide				NR

05/12/99

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INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

MJAH60

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 26891 SAS No.: SDG No.: MJAH52

Matrix (soil/water): WATER Lab Sample ID: 18765S

Level (low/med): LOW Date Received: 04/03/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	20.0	~~B~~	U	P
7440-36-0	Antimony	3.5	U	~~N~~ J	P
7440-38-2	Arsenic	3.7	U		P
7440-39-3	Barium	79.0	B		P
7440-41-7	Beryllium	0.30	U		P
7440-43-9	Cadmium	23.4		~~E~~ J	P
7440-70-2	Calcium	18400		~~E~~ J	P
7440-47-3	Chromium	0.70	U		P
7440-48-4	Cobalt	14.8	B	~~E~~ J	P
7440-50-8	Copper	7.8	B		P
7439-89-6	Iron	1150			P
7439-92-1	Lead	609		~~E~~ J	P
7439-95-4	Magnesium	50500		~~E~~ J	P
7439-96-5	Manganese	13300			P
7439-97-6	Mercury	1.5			CV
7440-02-0	Nickel	21.6	B	~~E~~ J	P
7440-09-7	Potassium	1220	B	~~E~~ J	P
7782-49-2	Selenium	~~3.1~~	~~U~~	~~N~~ R	P
7440-22-4	Silver	2.1	B	~~E~~ J	P
7440-23-5	Sodium	1150	B	~~E~~ J	P
7440-28-0	Thallium	5.6	B		P
7440-62-2	Vanadium	1.4	U		P
7440-66-6	Zinc	3660			P
	Cyanide				NR

05/12/99

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

MJAH61

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 26891 SAS No.: SDG No.: MJAH52

Matrix (soil/water): WATER Lab Sample ID: 18766S

Level (low/med): LOW Date Received: 04/03/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	7260			P
7440-36-0	Antimony	3.5	U	~~N~~ J	P
7440-38-2	Arsenic	144			P
7440-39-3	Barium	18.9	B		P
7440-41-7	Beryllium	2.1	B		P
7440-43-9	Cadmium	543		~~E~~	P
7440-70-2	Calcium	21500		~~E~~ J	P
7440-47-3	Chromium	0.70	U		P
7440-48-4	Cobalt	54.3		~~E~~ J	P
7440-50-8	Copper	284		J	P
7439-89-6	Iron	193000			P
7439-92-1	Lead	720		~~E~~	P
7439-95-4	Magnesium	46500		~~E~~	P
7439-96-5	Manganese	36800			P
7439-97-6	Mercury	1.3			CV
7440-02-0	Nickel	56.5		~~E~~ J	P
7440-09-7	Potassium	907	B	~~E~~	P
7782-49-2	Selenium	~~3.1~~	U	~~N~~ R	P
7440-22-4	Silver	15.9		~~E~~	P
7440-23-5	Sodium	106	U	~~E~~ J	P
7440-28-0	Thallium	16.4			P
7440-62-2	Vanadium	1.4	U	J	P
7440-66-6	Zinc	190000			P
	Cyanide				NR

05/12/99

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAH62

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 26891 SAS No.: SDG No.: MJAH52

Matrix (soil/water): WATER Lab Sample ID: 18767S

Level (low/med): LOW Date Received: 04/03/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	35300			P
7440-36-0	Antimony	13.2	B	~~N~~ J	P
7440-38-2	Arsenic	1770			P
7440-39-3	Barium	6.6	B		P
7440-41-7	Beryllium	7.0			P
7440-43-9	Cadmium	2060		~~E~~ J	P
7440-70-2	Calcium	99200		~~E~~ J	P
7440-47-3	Chromium	0.70	U		P
7440-48-4	Cobalt	761		~~E~~ J	P
7440-50-8	Copper	2600		J	P
7439-89-6	Iron	939000			P
7439-92-1	Lead	508		~~E~~ J	P
7439-95-4	Magnesium	122000		~~E~~ J	P
7439-96-5	Manganese	135000			P
7439-97-6	Mercury	0.76			CV
7440-02-0	Nickel	631		~~E~~ J	P
7440-09-7	Potassium	830	B	~~E~~ J	P
7782-49-2	Selenium	~~3.1~~	~~U~~	~~N~~ R	P
7440-22-4	Silver	48.2		~~E~~ J	P
7440-23-5	Sodium	12800		~~E~~ J	P
7440-28-0	Thallium	59.3			P
7440-62-2	Vanadium	1.4	U	J	P
7440-66-6	Zinc	907000			P
_____	Cyanide				NR

a/a 05/12/99

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

MJAH63

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 26891 SAS No.: SDG No.: MJAH52

Matrix (soil/water): WATER Lab Sample ID: 18768S

Level (low/med): LOW Date Received: 04/03/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	6640			P
7440-36-0	Antimony	3.5	U	~~N~~ J	P
7440-38-2	Arsenic	145			P
7440-39-3	Barium	35.7	B		P
7440-41-7	Beryllium	2.1	B		P
7440-43-9	Cadmium	423		~~E~~	P
7440-70-2	Calcium	35900		~~E~~	P
7440-47-3	Chromium	0.70	U		P
7440-48-4	Cobalt	104		~~E~~	P
7440-50-8	Copper	331			P
7439-89-6	Iron	188000			P
7439-92-1	Lead	635		~~E~~	P
7439-95-4	Magnesium	83100		~~E~~	P
7439-96-5	Manganese	56100			P
7439-97-6	Mercury	0.60			CV
7440-02-0	Nickel	103		~~E~~ J	P
7440-09-7	Potassium	1320	B	~~E~~ J	P
7782-49-2	Selenium	~~3.1~~	~~U~~	~~N~~ R	P
7440-22-4	Silver	15.9		~~E~~	P
7440-23-5	Sodium	106	U	~~E~~ J	P
7440-28-0	Thallium	22.0			P
7440-62-2	Vanadium	1.4	U	J	P
7440-66-6	Zinc	187000			P
_____	Cyanide				NR

05/12/99

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments: